PROPOSITIONS

belonging to the PhD thesis

Flagellar hydrodynamics of biological and biomimetic micro-swimmers

by

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1. The reversal of swimming direction is particularly important for micro-object manipulation in confined flow geometries. (*Chapter 1*)

2. The coordinated operation of ATP-powered dyneins is responsible for the flagellar waveforms and motility observed in nature. (*Chapter 2*)

3. Mastigonemes work as cilia and cause a reversal in swimming direction compared to a smooth flagellum. (*Chapter 3*)

4. A generic strategy to control propulsion at low-Reynolds numbers is by tuning the actuation sequence of two independently controlled degrees-of-freedom. (*Chapter 4*)

5. Biomimetic propulsive systems can be designed by exploiting the flagellar undulations for forward propulsion and synchronous ciliary beating of the mastigonemes for direction reversal. (*Chapter 4*)

6. Bi-directional bacterial swimming can be achieved by forming a chiral shape using magnetic forces, prior to actuation. (*Chapter 5*)

7. A partially-magnetized elastica can mimic swimming of either eukaryotic or prokaryotic flagellated micro-organisms when subjected to an oscillatory or rotating magnetic field, respectively. (*Chapter 4 & 5*)